CEILING LEAK CAPTURE AND DRAINAGE SYSTEM

Cross-Reference to Related Applications

This application is a continuation-in-part of U.S. Patent Application Serial No. 10/082,408, filed February 26, 2002, now U.S. Patent No. 6,640,502.

Background of the Invention

The present invention is directed toward a fluid leak capture and drainage system and more particularly, toward a system which will protect furniture, computer equipment, and the like from damage caused by leaks from a ceiling.

Suspended or hung ceilings are often used in businesses and offices and are used to finish and conceal the space between the ceiling and the roof or floor above which is used for air conditioning and heating ducts, electrical conduits, and piping. Leaks may occur from the aforementioned elements, from an opening in the roof of the building, or from faulty plumbing or the like. If a proper leak capture and drainage system is not in place during a leak, computer equipment, electronic devices, documents, furniture, and the like are likely to get damaged.

Many attempts to solve this problem have been proposed. For example, U.S. Patent No. 4,817,343 to Rutledge discloses a leak-proof ceiling system which includes a pair of elongated longerons suspended beneath the roof. Troughs are suspended between the longerons. Each longeron has a shield member so that fluid contacts the shield member and is directed into the trough. A drainage system empties

the troughs as they get filled. This device, however, cannot be installed into an existing ceiling and would therefore, be somewhat limited in its versatility and usefulness.

Also, U.S. Patent No. 5,299,591 to Duncan discloses a device for containing leaks above suspended ceilings. This device includes a receptacle which replaces a regular ceiling panel and is installed on the grid structure of the suspended ceiling. Fluid accumulates in the receptacle and is drained via an attached hose. However, because of the shape of the device, it may not be able to withstand significant leaks and thus, may not perform very effectively.

Other relevant inventions are shown in U.S. Patent No. 5,133,167 to Drew et al. and U.S. Patent No. 5,172,718 to Thornburgh. These inventions, however, do not appear to provide very effective drainage systems.

Summary of the Invention

The present invention is designed to overcome the deficiencies of the prior art discussed above. It is an object of the present invention to provide a drainage system which will protect furniture, computer equipment, and the like from damage caused by leaks from a ceiling.

It is another object of the present invention to provide a drainage system which can be installed easily in an existing suspended ceiling.

It is a further object of the present invention to provide a drainage system which includes a ceiling panel that maximizes fluid flow while minimizing the weight of the collected fluid and distributes the weight produced by the collection of fluid within the panel in an efficient manner.

In accordance with the illustrative embodiments demonstrating features and advantages of the present invention, there is provided a drainage system for ceiling leaks which includes a ceiling panel support grid and a plurality of ceiling panels mounted thereon. In one embodiment the ceiling panel has a raised platform located in the center of the panel and a wall extending along the periphery of the panel so that a perimeter trough is formed between the platform and the wall. The wall has a top edge and a rim extending outwardly and generally perpendicularly from the top edge of the wall and at least one opening formed through the wall. A fitting is connected to the opening and tubing is attached to the fitting for draining the trough as fluid collects therein. In other embodiments the panel includes a plurality of raised sections located within the panel and a plurality of troughs located between the raised sections and the walls. The walls have openings formed therein so that the troughs are in fluid communication with the openings.

Other objects, features, and advantages of the invention will be readily apparent from the following detailed description of the preferred embodiments thereof taken in conjunction with the drawings.

Brief Description of the Drawings

For the purpose of illustrating the invention, there is shown in the accompanying drawings forms which are presently preferred; it being understood that the invention is not intended to be limited to the precise arrangements and instrumentalities shown.

Figure 1 is a bottom perspective view of the ceiling panels of the present invention placed within a ceiling panel support grid;

Figure 2 is a cross-sectional view of the ends of two of the ceiling panels of the present invention connected together;

Figure 3 is a bottom perspective view of a ceiling panel of the present invention;

Figure 4 is a top perspective view of a ceiling panel of the present invention;

Figure 5 is a cross-sectional view of several of the ceiling panels of the present invention connected together and supported by a ceiling panel support grid;

Figure 6 is a top perspective view of a ceiling panel of the present invention placed within a ceiling panel support grid without a cap;

Figure 7 is a top perspective view of a ceiling panel of the present invention placed within a ceiling panel support grid with caps in place;

Figure 8 is a top perspective view of the caps of the present invention placed over the T-shaped structure of a ceiling panel support grid;

Figure 9 is a top perspective view of a second embodiment of the ceiling panel of the present invention;

Figure 10 is a bottom perspective view of the second embodiment of the ceiling panel of the present invention;

Figure 11 is a third embodiment of the ceiling panel of the present invention; and

Figure 12 is a fourth embodiment of the ceiling panel of the present invention.

Detailed Description of the Preferred Embodiments

Referring now to the drawings in detail wherein like reference numerals have been used throughout the various figures to designate like elements, there is shown in Figure 1 a drainage system constructed in accordance with the principles of the present invention and designated generally as 10.

The drainage system essentially includes a ceiling panel support grid and a plurality of ceiling panels 12, 14, 16, and 18 mounted thereon. The support grid consists of main hanger beams 20 and 22 and intermediate hanger beams 24 and 26 which form a grid. The grid is suspended by wire supports 28, 30, 32, and 34 which extend from a connector attached to above-ceiling support structures (not shown) to attachment means on the main hanger beams 20 and 22, such as apertures formed within the beams. (See Figure 6.) As is known in the art, the support grid beams 20, 22, 24 and 26 are in the shape of an inverted "T" structure. (See, for example, beam 22 of Figure 2.)

While the system of the present invention includes a plurality of identical ceiling panels, only one will be described in detail it being understood that the others are constructed in substantially the same manner. The ceiling panel 12 has a raised platform 36 located in the center of the panel 12 and a wall 38 extending along the periphery of the panel so that a trough 40 is formed between the platform 36 and the

wall 38. (See Figure 4.) The wall 38 has a top edge and a rim 42 extending outwardly and generally perpendicularly from the top edge of the wall and at least one opening 44a formed through the wall 38. Several openings 44b-44f may be located within the wall 38 at various locations, generally near the corners of each of the panels. Alternatively, the openings need not be located near the corners of the panels. For example, Figures 9 and 10 illustrate openings 144a and 144b located in various areas along the wall 138 of the panel. Furthermore, not all of the openings need to be used for the drain. That is, the openings may be punched out so that only the opening or openings that are needed are exposed. (See Figures 3 and 4.)

The panel 12 is sized to fit in a standard two foot by four foot or two foot by two foot ceiling grid via rim 42 resting on the T-shaped structure of the grid. (See Figure 2.) The shape of the ceiling panel allows fluid to collect along the perimeter of the panel, that is, within the trough 40, thereby evenly distributing the weight of the fluid being collected. The shape of the trough 40, relatively narrow with respect to depth, also allows for a maximum of developed fluid head with a minimum of fluid weight. Each panel may be made from painted steel, stainless steel, aluminum, plastic, coated fiberboard, or the like.

Pipe fittings are used to connect the panels to each other. As shown in Figure 2, a pipe 46 fits within opening 44a of panel 12. One end 48 of the pipe 46 has a flange 50 which abuts the interior side of the wall 38 of the panel 12. A ring gasket or O-ring may fit between the wall 38 and the flange 50 in order to insure a water tight fit. A nut 52 is threaded onto the opposite or exposed end 54 of the pipe 46. An elastomeric hose or tube 56 is placed over the exposed end 56 of the pipe 46. Similarly, a pipe 58

fits within an opening 44e in panel 14 and is held in place with nut 60. Hose 56 also fits over the exposed end of the pipe 58. In this manner, the panels 12 and 14 via the pipes 46 and 58 and hose 54 are in fluid communication with each other. This same arrangement continues throughout the entire system. (See Figure 5.) As fluid collects within the panels, it is drained though the pipes and hoses. A pipe or hose 62 may be attached to a panel closest to a room wall 64 to which all of the other panels drain.

A flange 66 extends vertically upwardly from the rim 42 of the wall 38 of the panel 12 and rests on the T-shaped structure of the grid. (See Figure 2.) The flange 66 or rim 42 may have openings formed therein in order to force overflow into a certain area in the highly unlikely event that the trough 40 does not drain and floods. Caps 68, 70, 72, and 74 are mounted between adjacent panels and extend over the T-shaped structure. (See Figures 7 and 8.) Each cap, for example, caps 68 and 70 may have a number of cut outs 76, 78, 80, and 82, for example, formed therein in order to fit over wire attachments 28, 30, 32, and 34. (See Figure 7.) The cap generally covers the rims and flanges of each of the panels. The cap intercepts and deflects fluid away from the rim of the panel and toward the drain. The joints between the caps and the various cut-outs in the caps are sealed with adhesive-backed, waterproof tape to provide a leak-tight assembly. Furthermore, mesh screens 84, 86, 88, 90, 92, and 94, for example, may be mounted within the trough adjacent the openings in order to prevent debris from clogging the drains. (See Figures 2, 4, and 5.)

Alternative embodiments of the present invention are shown in Figures 10 and 11. The panels are generally the same as described in the first embodiment with the differences described below. Each panel has at least one raised section and at

least one lower section forming a trough. For example, Figure 11 illustrates a panel 212 with four raised sections 236a, 236b, 236c, and 236d formed in the panel 212 with troughs 240a, 240b, 240c, and 240d formed between the raised sections 236a, 236b, 236c, and 236d and the wall 238. Drain openings are located in the wall, shown for example as opening 244, and are in fluid communication with the troughs. Preferably, the troughs are in communications with each other.

Figure 12 illustrates raised sections 336a, 336b, 336c, and 336d of the panel 312 located generally in the corners with troughs 340a, 340b, 340c, and 340d formed between the raised sections 336a, 336b, 336c, and 336d and the wall 338. The raised sections may be slightly curved. Openings are located along the wall, shown for example as opening 344, and are in fluid communication with the troughs.

The panels illustrated in Figures 11 and 12 and described above function in the same manner as the panels discussed in the previous embodiments. Other embodiments are also possible where the location of the openings and the location, size, and shape of the raised sections may be varied.

In all of the embodiments, not all of the panels in a ceiling need to be replaced with the present invention, only the panels selected by the installer. In this manner, only the areas of the room that need the most protection from damage caused by leaks from the ceiling will be protected.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and accordingly, reference should be made to the appended claims rather than to the foregoing specification as indicating the scope of the invention.